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PROVENANCE VARIATION IN SEED OIL YIELD FROM *Calophyllum inophyllum* GROWN IN COASTAL UTTARA KANNADA AND PHYSICO CHEMICAL CHARACTERIZATION OF OIL

SHAMALA K. V. & P. RAMANA

Department of Biochemistry, College of Agriculture, Dharwad University of Agricultural Sciences, Dharwad, India

ABSTRACT

Studies on effect of provenance on seed oil yield and its physico-chemical characterization of oil of Calophyllum inophyllum, provenance influence on seed oil content and its physico-chemical properties were conducted in Uttara Kannada district (Agro-climatic Zone-10) of Karnataka during 2014-2015. Study was undertaken in the already existing trees in natural forests at five different locations with varying altitudes (2.7-26.6 m) and rainfall (3209-4145 mm). Seed oil yield were highly variable ranges from 36.07 to 48.87 percent. Honnavar sites recorded highest oil yield of 48.87 per cent and the lowest oil yield was recorded in Kumta sites (36.07 %). Sites near coastal area recorded highest oil yield (44.51 %) and sites away from coastal area recorded lowest (42.50 %). The percentages varied significantly among the locations and sites which indicate potential effects of the locality on oil content. C. inophyllum oil was greenish yellow in colour with disagreeable odour. Oil is having kinematic viscosity of 38.17 cSt (at 40 °C), density of 933 (kg/m3 at 30 °C), acid value of 39.6 (mg KOH/g), specific gravity of 0.933 (at 30 °C), free fatty acid content of 34.08, saponification value of 202.71 and iodine value of 93.05.

KEYWORDS: C. inophyllum, Variation, Seed Oil Yield & Physico-chemical Properties

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Original Article

INTRODUCTION

Calophyllum inophyllum Linn, belongs to plant family Clusiaceae (Mangosteen family), locally known as 'Sura-honne' or 'Hu-honne' in Kannada and Alexander Laurel (English). It occurs in coastal forests on west and east coast of India. It is typically 8-20 m (25-65 ft.) tall at maturity and widely dispersed throughout the tropical Asia (India, Sri Lanka, Thailand, Indonesia, Malaysia, Philippines), including the Hawaiian and other Pacific islands upto 800 m (2000 ft.) at the equator, mean annual temperatures 18-33 °C (64-91 °F) annual rainfall 1000-5000 mm. It is an important timber and oil yielding tree species of the coastal region. Reddish brown wood is strong and durable even under salt water, hence regularly used in ship/fishing boat building. Kernels yield crude oil, used in soap industry. Apart from this usage, different parts of the plant can be used in medicine (Chopra, 1933).

It is a multipurpose, one of the non-edible tree borne oilseeds (TBO's) containing nearly 50-75 per cent oil. Generally, a well grown tree produces up to 100 kg of fruits and about 18 kg of oil (Venkanna and Reddy, 2009). Several authors reported that the variation in oil yield was 31.17 to 42 per cent in *Pongamia pinnata* (Raut *et al*., 2011), 31 to 57 (%) in *Calophyllum inophyllum* (Subhash *et al*., 2011), 40 percent in *Simarouba glauca* seeds 55 to 65 percent in kernel of *Simarouba glauca* (Mishra *et al*., 2012) and in *Jatropha curcas* oil

content of sources varies from 48.8 to 56.7 per cent (Sama *et al*., 2013).

MATERIAL AND METHODS

Seed Oil Extraction

Seeds were drawn randomly from the pods harvested from the identified trees, three from each site and six from each location. Samples were collected from five different locations of Hilly zone in the month of May, 2014. The samples were immediately preserved in polyethylene bags and transferred to laboratory**.** The geographic information of these sites was recorded by using GPS model. The seeds were sun dried. The dried kernel were blended and mixed thoroughly in a Kenstar food mixer. The powdered sample was stored in an air-tight jar and kept in the refrigerator prior to the analysis. Oil was extracted by soxhlet extraction method using solvent petroleum ether. Moisture in the oil samples was removed by adding anhydrous sodium sulphate.

Physico-chemical Characterization of Oil

Colour and aroma of oil samples were recorded with visual observations and smelling. By using viscometer the kinematic viscosity was measured as per the Perkins martin cup method (AOAC, 1990). The specific gravity of oil was measured as per the method of AOAC (1990). The acid value and free fatty acid content was estimated as per the method of AOAC (1975). The iodine number was determined by Hanus iodine method AOAC (1975). The saponification number was estimated as per the method of AOAC (1975).

RESULTS AND DISCUSSIONS

The results of seed oil yield from *Calophyllum inophyllum* are presented in Table 1. The oil yield varied from 36.07 to 48.87 per cent. Among the locations the higher oil yield was recorded at Honnavar (48.87 %) followed by Karwar (47.47 %), Ankola (44.58 %), Bhatkal, (40.54 %) and Kumta recorded lowest oil yield of 36.07 per cent. There was a significant influence of sites in oil yield with highest oil yield recorded near coastal area (44.51 %) when compare to sites away from coastal area (42.50 %). The seed oil yield was significantly influenced by different locations and sampling sites.

The present findings on oil yield variation are in agreement with the studies of Subhash *et al*. (2011) who reported the oil content variation in *C. inophyllum L.* seeds from Anuradhapura, Sri Lanka recorded the highest oil content (57 %) and seeds from Cardwell Australia recorded the lowest oil content (31 %).

The oil production in a plant depends on various factors and stress conditions prevailing at the site. This may be due to high wet conditions near coastal region. Similar findings were reported by Sangwan *et al*. (2001) who reported that tree oil yield increase in the wet conditions. Higher oil yield reported in sites near coastal areas in the present investigation may be attributed to the wet conditions prevailing near the coast. However, present findings agree with the results of reported higher oil yield under low rainfall conditions reported by Subhash *et al*. (2011) in different provenances of Australia and srilanka in *C. inophyllum*. The interaction effect of oil yield was also differed significantly. That biomass production in oil plantations is strongly influenced by the climatic and edaphic features of a given planting location and the quality of establishment of plantings (Doran and Bell, 1994 and Wildy *et al.*, 2000).

Table 1: Oil Yield from *Calophyllum inophyllum* Seeds

Locations	Oil Yield (%)		
	Sampling Sites		
	S_1	S_2	Mean
L_1	41.06	53.87	47.47
L_2	36.92	52.24	44.58
L_3	31.76	40.38	36.07
L_4	47.88	49.87	48.87
L_5	34.80	46.27	40.54
Mean	42.50	44.51	
	S.Em±		CD@1%
L	0.06		0.26
S	0.08		0.04
L×S	0.12		0.48

Note: L_1- Karwar, L_2-Ankola, L_3- Kumta, L_4-Honnavar, L_5-Bhatkal
S_1- 2-5 km away from coastal region, S_2- with in ½ km from coastal region

It may be noted that under favorable conditions seeds store a large amount of storage materials which are mostly carbohydrates (Ibrahim *et al*., 1997) and in harsher conditions they produce slightly smaller oil-rich seeds (Rose, 1988). The observed variability in the oil content of *C. inophyllum* might be due to the variation in different site conditions.

Physico-chemical properties of *C. inophyllum* oil are presented in Table 2. The quality of oil has been characterized in terms of physico-chemical properties. *C. inophyllum* oil was greenish yellow in colour with disagreeable odour. Oil was having kinematic viscosity of 38.17 cSt (at 40 °C), density of 0.933 (kg/m^3 at 30 °C), acid value of 39.6 (mg KOH/g), specific gravity of 933 (at 30 °C), free fatty acid content of 34.08 saponification value of 202.71 and iodine value of 93.05. Physicochemical properties of *Calophyllum inophyllum* oil observed in the present investigation was similar to that reported by Chavan *et al*. (2013) in *C. inophyllum.* They reported that *C. inophyllum* oil was greenish yellow in colour with disagreeable odour having the specific gravity of 0.908 (at 30 ºC), free fatty acids (28.16 % FFA) and saponification value (203) as well as kinematic viscosity (38.17 cSt at 40 ºC) and density (910 kg/m^3 at 30 ºC). The present findings of the investigation also receive further support from the studies of Atbani *et al.* (2014) who studied the physical properties of *C. inophyllum* oil with acid value of 44 (mg KOH/g), specific gravity of 0.896 (at 30 ºC) and kinematic viscosity of 71.98 (cSt at 40 ºC) and saponification value (194.70).

CONCLUSIONS

The present study was aimed at the influence of provenance variation on oil yield and the oil yield was varied significantly with different locations and sites. Oil is having kinematic viscosity of 38.17 cSt (at 40 °C), density of 933 (kg/m^3 at 30 °C), acid value of 39.6 (mg KOH/g), specific gravity of 0.933 (at 30 °C), free fatty acid content of 34.08 (as oleic acid equivalent), saponification value of 202.71 and iodine value of 93.05 and study of these parameters helps us to use *C. inophyllum* seed oil as a source of biodiesel production.

Table 2: Physico-chemical Properties of *Calophyllum inophyllum* Seed Oil from Site Near Coastal Area of Bhatkal

Parameter	Value
Organoleptic Properties	
Colour	Greenish yellow
Odour	Disagreeable
Physical Properties	
Kinematic viscosity at 40 °C (cSt)	38.17

Table 2: Contd.,	
Density at 30 °C (kg/m^3)	933
Acid value (mg KOH/g)	39.6
FFA (as oleic acid)	34.08
Specific gravity at 30 ºC	0.933
Saponification value	202.71
Iodine value	93.05

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